## Program Requirements

### Biochemistry and Biotechnology

#### B.Sc. Honours (20.0 credits)

<table>
<thead>
<tr>
<th>Item</th>
<th>Credits</th>
<th>Description</th>
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</thead>
</table>
| 1.   | 2.5     | BiOL 1103 [0.5] Foundations of Biology I  
|      |         | BiOL 1104 [0.5] Foundations of Biology II  
|      |         | BiOL 2104 [0.5] Introductory Genetics  
|      |         | BiOL 2303 [0.5] Microbiology  
|      |         | BiOL 3104 [0.5] Molecular Genetics  
| 2.   | 0.5     | BiOL 2001 [0.5] Animals: Form and Function  
|      |         | BiOL 2002 [0.5] Plants: Form and Function  
| 3.   | 0.5     | BiOL 3201 [0.5] Cell Biology  
|      |         | BiOL 3205 [0.5] Plant Biochemistry and Physiology  
|      |         | BiOL 3303 [0.5] Experimental Microbiology  
|      |         | BiOL 3305 [0.5] Human and Comparative Physiology  
| 4.   | 1.5     | BiOL 2301 [0.5] Biotechnology I  
|      |         | BiOL 3201 [0.5] Cell Biology  
|      |         | BiOL 3301 [0.5] Biotechnology II  
|      |         | BiOL 3303 [0.5] Experimental Microbiology  
|      |         | BiOL 4106 [0.5] Advances in Molecular Biology  
|      |         | BiOL 4109 [0.5] Laboratory Techniques in Molecular Genetics  
|      |         | BiOL 4201 [0.5] Advanced Cell Culture and Tissue Engineering  
|      |         | BiOL 4300 [0.5] Applied Microbiology  
|      |         | BiOL 4301 [0.5] Current Topics in Biotechnology  
| 5.   | 3.0     | BIOC 2200 [0.5] Cellular Biochemistry  
|      |         | BIOC 3101 [0.5] General Biochemistry I  
|      |         | BIOC 3102 [0.5] General Biochemistry II  
|      |         | BIOC 3103 [0.5] Practical Biochemistry I  
|      |         | BIOC 3104 [0.5] Practical Biochemistry II  
|      |         | BIOC 3202 [0.5] Biophysical Techniques and Applications  
| 6.   | 1.0     | BIOC 4907 [1.0] Honours Essay and Research Proposal  
|      |         | BIOC 4908 [1.0] Research Project  
| 7.   | 1.0     | BIOC 4004 [0.5] Industrial Biochemistry  
|      |         | BIOC 4005 [0.5] Biochemical Regulation  
|      |         | BIOC 4007 [0.5] Membrane Biochemistry  
|      |         | BIOC 4009 [0.5] Biochemistry of Disease  
|      |         | BIOC 4200 [0.5] Immunology  
|      |         | BIOC 4201 [0.5] Advanced Cell Culture and Tissue Engineering  
|      |         | BIOC 4202 [0.5] Mutagenesis and DNA Repair  
|      |         | BIOC 4203 [0.5] Advanced Metabolism  
|      |         | BIOC 4204 [0.5] Protein Biotechnology  
| 8.   | 4.0     | CHEM 1001 [0.5] General Chemistry I  
|      |         | CHEM 1002 [0.5] General Chemistry II  
|      |         | CHEM 2103 [0.5] Physical Chemistry I  
|      |         | CHEM 2303 [0.5] Physical Chemistry II  
|      |         | CHEM 2501 [0.5] Introduction to Inorganic and Bioinorganic Chemistry  
|      |         | CHEM 3201 [0.5] Advanced Organic Chemistry I  
|      |         | CHEM 3202 [0.5] Advanced Organic Chemistry II  
|      |         | CHEM 3205 [0.5] Experimental Organic Chemistry  
| 9.   | 0.5     | BIOC 4901 [0.5] Methods in Biochemistry  
|      |         | BIOC 4902 [0.5] Computational Systems Biology  
|      |         | BIOC 4903 [0.5] Selected Topics in Biochemistry  
|      |         | BIOC 4904 [0.5] Advanced Plant Physiology  
|      |         | BIOC 4905 [0.5] Advanced Plant Physiology - BIOL courses listed in but not used to fulfill Item 4 above  
|      |         | CHEM 3100 [0.5] Physical Chemistry II  
|      |         | CHEM 3107 [0.5] Experimental Methods in Nanoscience  
|      |         | CHEM 3202 [0.5] Advanced Organic Chemistry II  
|      |         | CHEM 3205 [0.5] Experimental Organic Chemistry  
|      |         | CHEM 3600 [0.5] Introduction to Nanotechnology  
|      |         | CHEM 3700 [0.5] Industrial Applications of Chemistry  
|      |         | CHEM 3800 [0.5] The Chemistry of Environmental Pollutants  
|      |         | CHEM 4201 [0.5] Macromolecular Nanotechnology  
|      |         | CHEM 4406 [0.5] Pharmaceutical Drug Design  
| 10.  | 0.5     | BIOC courses listed in, but not used to fulfill, Item 7 above  
|      |         | BIOC 2400 [0.5] Independent Research I  
|      |         | BIOC 4300 [0.5] Independent Research II  
|      |         | BIOC 3008 [0.5] Bioinformatics  
|      |         | CHEM 3102 [0.5] Mycology  
|      |         | CHEM 3102 [0.5] Principles of Developmental Biology  
|      |         | CHEM 3306 [0.5] Human Anatomy and Physiology  
|      |         | CHEM 3307 [0.5] Advanced Human Anatomy and Physiology  
|      |         | BIOL 4206 [0.5] Human Genetics  
|      |         | BIOL 4209 [0.5] Advanced Plant Physiology  
|      |         | - BIOL courses listed in but not used to fulfill Item 4 above  
|      |         | CHEM 3100 [0.5] Physical Chemistry II  
|      |         | CHEM 3107 [0.5] Experimental Methods in Nanoscience  
|      |         | CHEM 3202 [0.5] Advanced Organic Chemistry II  
|      |         | CHEM 3205 [0.5] Experimental Organic Chemistry  
|      |         | CHEM 3600 [0.5] Introduction to Nanotechnology  
|      |         | CHEM 3700 [0.5] Industrial Applications of Chemistry  
|      |         | CHEM 3800 [0.5] The Chemistry of Environmental Pollutants  
|      |         | CHEM 4201 [0.5] Macromolecular Nanotechnology  
|      |         | CHEM 4406 [0.5] Pharmaceutical Drug Design  

<table>
<thead>
<tr>
<th>B. Credits Not Included in the Major CGPA (5.0 credits)</th>
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<tbody>
<tr>
<td>11. 1.0 credit from:</td>
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</tbody>
</table>
| PHYS 1007 [0.5] Elementary University Physics I  
| & PHYS 1008 [0.5] Elementary University Physics II  
| PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics  
| & PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion  
| 12. 1.5 credits in: |
| BIOL 1104 [0.5] Foundations of Biology II  
| BIOL 2001 [0.5] Plants: Form and Function  
| BIOL 2002 [0.5] Plants: Form and Function  
| BIOL 2200 [0.5] General Biochemistry I  
| BIOL 3101 [0.5] Practical Biochemistry I  
| BIOL 3102 [0.5] Practical Biochemistry II  
| BIOL 3201 [0.5] Advanced Cell Culture and Tissue Engineering  
| BIOL 3202 [0.5] Biophysical Techniques and Applications  
| BIOL 3205 [0.5] Plant Biochemistry and Physiology  
| BIOL 3303 [0.5] Experimental Microbiology  
| BIOL 3305 [0.5] Human and Comparative Physiology  
| BIOC 4901 [0.5] Methods in Biochemistry  
| BIOC 4902 [0.5] Computational Systems Biology  
| BIOC 4903 [0.5] Selected Topics in Biochemistry  
| BIOC 4904 [0.5] Advanced Plant Physiology  
| CHEM 3100 [0.5] Physical Chemistry II  
| CHEM 3107 [0.5] Experimental Methods in Nanoscience  
| CHEM 3202 [0.5] Advanced Organic Chemistry II  
| CHEM 3205 [0.5] Experimental Organic Chemistry  
| CHEM 3600 [0.5] Introduction to Nanotechnology  
| CHEM 3700 [0.5] Industrial Applications of Chemistry  
| CHEM 3800 [0.5] The Chemistry of Environmental Pollutants  
| CHEM 4201 [0.5] Macromolecular Nanotechnology  
| CHEM 4406 [0.5] Pharmaceutical Drug Design  

**UNOFFICIAL 2017-2018 Carleton University Undergraduate Calendar**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1007</td>
<td>Elementary Calculus I</td>
<td>[0.5]</td>
</tr>
<tr>
<td>MATH 1107</td>
<td>Linear Algebra I</td>
<td>[0.5]</td>
</tr>
<tr>
<td>STAT 2507</td>
<td>Introduction to Statistical Modeling I</td>
<td>[0.5]</td>
</tr>
</tbody>
</table>

**13. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)**

**14. 0.5 credit in free elective.**

**Total Credits: 20.0**

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**Biology and Biotechnology B.Sc. Honours (20.0 credits)**

**A. Credits Included in the Major CGPA (12.5 credits)**

1. **6.0 credits in:**
   - BIOL 1103 [0.5] Foundations of Biology I
   - BIOL 1104 [0.5] Foundations of Biology II
   - BIOL 2001 [0.5] Animals: Form and Function
   - BIOL 2002 [0.5] Plants: Form and Function
   - BIOL 2104 [0.5] Introductory Genetics
   - BIOL 2200 [0.5] Cellular Biochemistry
   - BIOL 2301 [0.5] Biotechnology I
   - BIOL 2303 [0.5] Microbiology
   - BIOL 3104 [0.5] Molecular Genetics
   - BIOL 3201 [0.5] Cell Biology
   - BIOL 3301 [0.5] Biotechnology II
   - BIOL 4301 [0.5] Current Topics in Biotechnology

2. **1.0 credit in:**
   - BIOC 3101 [0.5] General Biochemistry I
   - BIOC 3102 [0.5] General Biochemistry II

3. **4.5 credits from:**
   - BIOC 2300 [0.5] Physical Biochemistry
   - or CHEM 2103 [0.5] Physical Chemistry I
   - BIOC 3008 [0.5] Bioinformatics
   - BIOC 3103 [0.5] Practical Biochemistry I
   - BIOC 3104 [0.5] Practical Biochemistry II
   - BIOC 3202 [0.5] Biophysical Techniques and Applications
   - BIOL 3004 [0.5] Insect Diversity
   - BIOL 3102 [0.5] Mycology
   - BIOL 3205 [0.5] Plant Biochemistry and Physiology
   - BIOL 3303 [0.5] Experimental Microbiology
   - BIOL 3305 [0.5] Human and Comparative Physiology
   - BIOL 3501 [0.5] Biomechanics
   - BIOL 3901 [0.5] Research Proposal
   - BUSI 2800 [0.5] Entrepreneurship
   - CHEM 3700 [0.5] Industrial Applications of Chemistry
   - CHEM 3800 [0.5] The Chemistry of Environmental Pollutants
   - FOOD 3005 [0.5] Food Microbiology
   - BIOC 4001 [0.5] Methods in Biochemistry
   - BIOC 4004 [0.5] Industrial Biochemistry
   - BIOC 4005 [0.5] Biochemical Regulation
   - BIOC 4007 [0.5] Membrane Biochemistry
   - BIOC 4008 [0.5] Computational Systems Biology
   - BIOC 4009 [0.5] Biochemistry of Disease
   - BIOC 4203 [0.5] Advanced Metabolism
   - BIOC 4204 [0.5] Protein Biotechnology
   - BIOC 4708 [0.5] Principles of Toxicology
   - BIOL 4106 [0.5] Advances in Molecular Biology
   - BIOL 4109 [0.5] Laboratory Techniques in Molecular Genetics
   - BIOL 4200 [0.5] Immunology
   - BIOL 4201 [0.5] Advanced Cell Culture and Tissue Engineering
   - BIOL 4202 [0.5] Mutagenesis and DNA Repair
   - BIOL 4206 [0.5] Human Genetics
   - BIOL 4901 [0.5] Directed Special Studies
   - TSES 4001 [0.5] Technology and Society: Risk
   - TSES 4002 [0.5] Technology and Society: Forecasting

4. **1.0 credit in:**
   - BIOL 4905 [1.0] Honours Workshop
   - or BIOL 4907 [1.0] Honours Essay and Research Proposal
   - or BIOL 4908 [1.0] Honours Research Thesis

**B. Credits Not Included in the Major CGPA (7.5 credits)**

5. **2.0 credits in:**
   - CHEM 1001 [0.5] General Chemistry I
   - & CHEM 1002 [0.5] General Chemistry II
   - CHEM 2203 [0.5] Organic Chemistry I
   - & CHEM 2204 [0.5] Organic Chemistry II (See Note below)

6. **1.0 credit in:**
   - BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation
   - MATH 1007 [0.5] Elementary Calculus I

7. **1.5 credits from:**
   - COMP 1005 [0.5] Introduction to Computer Science I
   - COMP 1006 [0.5] Introduction to Computer Science II
   - MATH 1107 [0.5] Linear Algebra I
   - PHYS 1007 [0.5] Elementary University Physics I
   - or PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics
   - PHYS 1008 [0.5] Elementary University Physics II
   - or PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion
   - STAT 2507 [0.5] Introduction to Statistical Modeling I

8. **2.0 credits in**
   - Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)

9. **1.0 credit free elective.**

**Total Credits: 20.0**

**Note:** For Item 5 above, CHEM 1001 General Chemistry I and CHEM 1002 General Chemistry II are strongly recommended for this program. Students may substitute CHEM 1001 General Chemistry I and CHEM 1002 General Chemistry II with CHEM 1005 Elementary Chemistry I and CHEM 1006 Elementary Chemistry II, respectively. Students choosing CHEM 1005 Elementary Chemistry I and CHEM 1006 Elementary Chemistry II will be required to obtain a grade of B- or higher in CHEM 1006 Elementary Chemistry II to take BIOC 2200 Cellular Biochemistry and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 Elementary Chemistry I with a grade of B- or higher are encouraged to register for CHEM 1002 General Chemistry II.